



# A DECADE OF PROTECTION 10 YEARS OF CHANGE AT THE CHANNEL ISLANDS

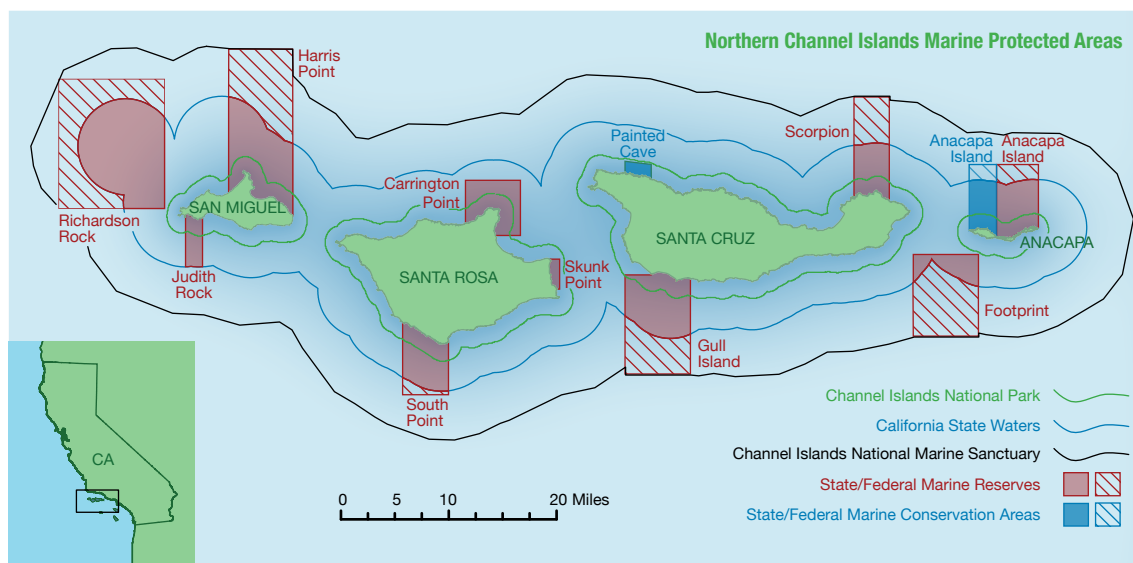
## BACKGROUND

In 2003, California established thirteen marine protected areas (MPAs) in state waters around the northern Channel Islands, off the coast of Southern California. In 2007, the National Oceanic and Atmospheric Administration extended these MPAs into federal waters of the Channel Islands National Marine Sanctuary. These areas, most of which are no-take marine reserves, were designed to help restore biodiversity and ecosystem health by protecting local marine life and habitats. To evaluate whether the MPAs are meeting their ecological goals, scientists from the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) have been monitoring these rocky reef and kelp forest communities for over a decade.

In 2008, PISCO scientists found that after five years of protection, fish species targeted by fishermen had both greater density (numbers of fish per area) and biomass (total weight per area) inside MPAs compared to outside "reference" sites. Though these and other results from the five-year review were promising indicators that MPAs are beneficial to marine life, studies of other long-term protected places suggested the full effects of these protected areas were likely to take decades to develop.

2013 marked the ten-year anniversary of the Channel Islands' MPAs. We now have the opportunity to explore longer-term trends and better understand the effects of these areas on California's ocean health.

This report updates the previous analyses comparing patterns inside and outside of MPAs, and also provides, for the first time, an evaluation of ecological changes detected since the MPAs were established.

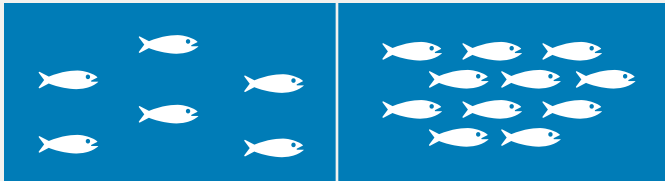


# MARINE PROTECTED AREAS CONTINUE TO SHOW POSITIVE EFFECTS

## MEASURING MPA RESPONSES

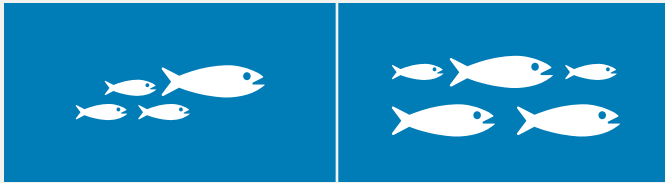
### HIGHER DENSITY = MORE SEA LIFE

Density is the total number of organisms in a given area.



### INCREASES IN BIOMASS = BIGGER AND MORE ABUNDANT SEA LIFE

Biomass is the total weight of organisms in a given area, in terms of both size *and* number of organisms.



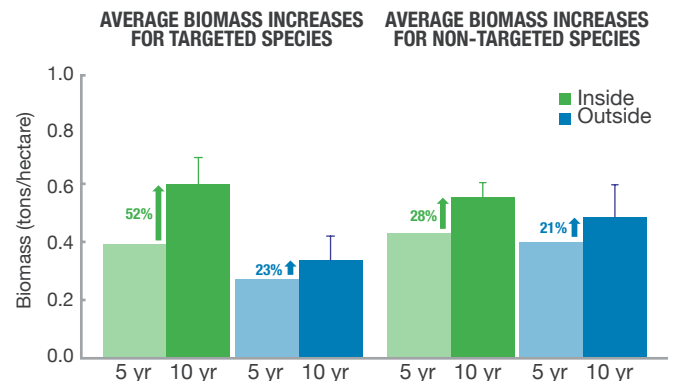
### MORE AND BIGGER SEA LIFE = A HEALTHIER OCEAN

Together, density and biomass measurements help us understand how well fish and invertebrates are doing in an area. Increases in biomass and density can indicate that marine life is responding positively to protection from MPAs.



## 1 Positive effects observed after five years have continued and are even more pronounced after ten years. Fish and invertebrates are bigger and more abundant.

- The average biomass of fish targeted by fishermen, such as rockfish, increased both inside and outside of MPAs since the five-year review, but the increase is much greater inside MPAs where fish are protected.
- The average biomass of fish species not targeted by fishermen also increased since the five-year review both inside and outside MPAs.
- Invertebrate species subject to high fishing pressure, such as California spiny lobster, sea cucumber and red urchin, are more abundant inside reserves. Unfished and lightly fished invertebrate species show no consistent patterns relative to protection; some are more abundant inside and some are more abundant outside MPAs.

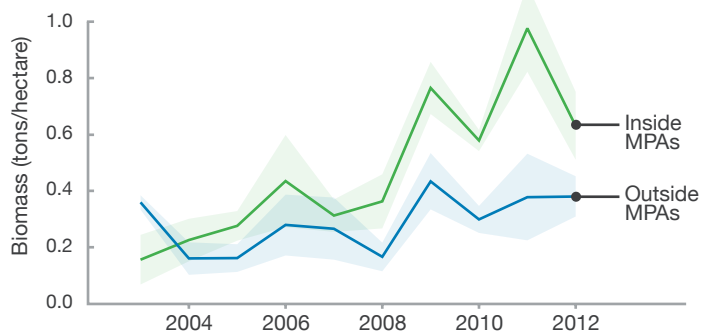




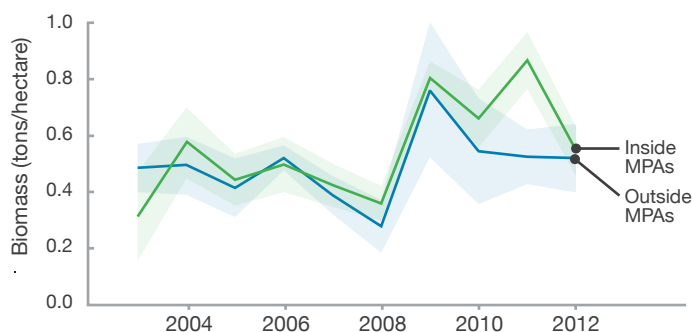
## 2 MPAs foster more and bigger fish in less time.

- Despite large fluctuations in biomass from year to year, the average biomass of targeted fish species is increasing more quickly inside MPAs compared with outside. Non-targeted fish species also increased but there were no clear differences inside or outside MPAs.
- The increase in targeted fish species outside of MPAs suggests that shifting fishing effort has not overtaxed fish species in open areas near MPA boundaries. Scientists are working to understand whether this increase is related to changes in fishing patterns around MPAs, fish spilling over from MPAs to fished areas outside, changes in ocean conditions, or a combination of these factors.

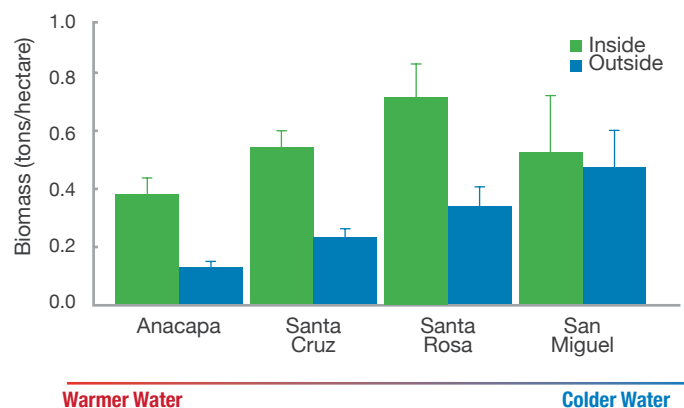
BIOMASS OF TARGETED SPECIES



BIOMASS OF NON-TARGETED SPECIES



BIOMASS OF TARGETED SPECIES SHOWS GREATER RESPONSE IN WARMER WATER.



## 3 MPA responses can differ across a region.

- The northern Channel Islands lie within a transition zone where cold waters from the north meet warm waters from the south. Distinct groupings of marine life are associated with different parts of this spectrum of water temperatures throughout the islands. These diverse areas can respond differently to the establishment of MPAs.
- Not all MPAs perform the same way. In warmer water surrounding the eastern islands, biomass of targeted species was higher within MPAs compared to areas outside. In contrast, at San Miguel, where MPAs are located in colder waters, biomass of targeted species showed no significant difference between the MPA and outside, unprotected areas. These dissimilar MPA responses could be due to differences in the amount of fishing across the islands combined with differences in growth rates of the animals.

Warmer Water

Colder Water



# TEN YEARS LATER

## MPAs ARE WORKING TO RESTORE OCEAN HEALTH

**The Channel Islands MPAs appear to be fulfilling their role as refuges for many fish and invertebrate species.** Heavily targeted species are bigger and more abundant inside these protected areas than in fished areas, and the increases are more pronounced and rapid inside MPAs compared to areas nearby. More sea life within marine reserves and other protected areas will likely result in benefits to areas outside, contributing to overall ocean health. Healthy marine ecosystems can better withstand the pressures of climate change and other stressors such as overfishing and poor water quality.

**Results from the first decade of monitoring at the Channel Islands show the positive effects of marine protected areas and provide a window into the ecological improvements that, over time, we hope to see from the newly established statewide MPA network in California.** Ongoing monitoring of the Channel Islands MPAs and the rest of the state's protected areas will be critical to understanding the performance of the network as a whole.

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